

Differentiation of Exponential Functions

e is an irrational number approximately equal to 2.718282 (6dp). The exponential function $y = e^x$ is the only function which is its own derivative, i.e.

If $y = e^x$, then $y' = e^x$.

If $y = ne^{ax}$, then $y' = a \cdot ne^{ax}$

If $y = ne^{f(x)}$, then $y' = f' \cdot ne^{f(x)}$

Example: Differentiate these functions.

$$1) y = e^{7x} \qquad y' = 7 \cdot e^{7x}$$

$$2) y = 45e^{12x} \qquad y' = 12 \cdot 45e^{12x} = 540e^{12x}$$

$$3) y = 5e^{2x+3} \qquad y' = 2 \cdot 5e^{2x+3} = 10e^{2x+3}$$

$$4) y = e^{6x^3} \qquad y' = 18x^2 \cdot e^{6x^3}$$

$$5) y = \frac{1}{e^{2x}} \qquad y = e^{-2x}$$
$$y' = -2e^{-2x}$$

$$6) y = e^{\sqrt{x}} \qquad y = e^{x^{1/2}}$$
$$y' = \frac{1}{2}x^{-1/2} \cdot e^{x^{1/2}} = \frac{1}{2x^{1/2}} \cdot e^{x^{1/2}} = \frac{e^{\sqrt{x}}}{2\sqrt{x}}$$